Recovery Plan For The Palezone Shiner (Notropis albisonatus)



RECOVERY PLAN

for

Palezone Shiner (Notropis albizonatus)

Prepared by

Melvin L. Warren, Jr.
U.S. Forest Service
Southern Forest Experiment Station
Oxford, Mississippi

Brooks M. Burr
Department of Zoology
Southern Illinois University
Carbondale, Illinois

and

Richard G. Biggins
Asheville Field Office
U.S. Fish and Wildlife Service
Asheville, North Carolina

for

U.S. Fish and Wildlife Service Region 4 Atlanta, Georgia

Approved: Acting Regional Director, U.S. Fish and Wildlife Service

Date: $\frac{\gamma/7/97}{}$

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans published by the U.S. Fish and Wildlife Service are sometimes prepared with the assistance of recovery teams, contractors, State agencies, and other affected and interested parties. Plans are reviewed by the public and submitted to additional peer review before they are adopted by the U.S. Fish and Wildlife Service. Objectives of the plan will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific tasks and may not represent the views nor the official positions or approval of any individuals or agencies involved in developing the plan, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Director or Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

By approving this recovery plan, the Regional Director certifies that the data used in its development represent the best scientific and commercial information available at the time it was written. Copies of all documents reviewed in the development of the plan are available in the administrative record, located at the Asheville, North Carolina, Field Office.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1997. Recovery Plan for Palezone Shiner (*Notropis albizonatus*). Atlanta, GA. 27 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service 5430 Grosvenor Lane, Suite 110 Bethesda, Maryland 20814

Telephone: 301/492-6403 or

1-800/582-3421

Fees for recovery plans vary, depending upon the number of pages.

EXECUTIVE SUMMARY

Current Status: The palezone shiner (*Notropis albizonatus*) was listed as an endangered species on April 27, 1993. Although this shiner was likely once more widespread within the Tennessee and Cumberland Rivers, this small fish (60 mm long) is presently known from only two widely disjunct populations. Two other populations have been lost. Although the palezone shiner has been known to ichthyologists for at least 20 years, little documentation is available on its biology.

Habitat Requirements and Limiting Factors: The palezone shiner occurs in large creeks and small rivers. Populations of this species have been fragmented by habitat alteration (primarily impoundments), and extant populations are being impacted by deteriorated water quality primarily resulting from poor land-use practices (principally agriculture and coal mining). The species' present limited distribution also makes it vulnerable to extirpation from stochastic events.

Recovery Objective: Downlisting. Because much of the species' presumed historic habitat has been impounded or altered by other factors, it is unlikely that the species can be recovered to the point of delisting.

Downlisting Criteria: Establish viable populations of the palezone shiner in the Little South Fork of the Cumberland River and the Paint Rock River.

Actions Needed:

- 1. Use existing legislation/regulations to protect the species.
- 2. Determine threats and alleviate those that imperil the species' existence.
- 3. Determine the species' life history requirements.
- 4. Solicit the assistance of local landowners and initiate projects (i.e., "Partners for Wildlife") to improve riparian habitat.
- 5. Develop and implement an information and education program.
- 6. Through augmentation or reintroduction, protect and establish viable populations in the Little South Fork of the Cumberland River and the Paint Rock River.
- 7. Search for additional populations.

Cost (\$000s):

YEAR	NEED 1	NEED 2	NEED 3	NEED 4	NEED 5	NEED 6	NEED 7	TOTAL
1997	5.0	10.0	10.0	25.0	15.0	0.0	0.0	65.0
1998	5.0	10.0	10.0	25.0	5.0	0.0	20.0	75.0
1999	5.0	10.0	10.0	25.0	5.0	20.0	0.0	75.0
2000	5.0	10.0	10.0	25.0	5.0	20.0	0.0	75.0
2001	5.0	0.0	0.0	0.0	0.0	20.0	0.0	25.0
2002	5.0	0.0	0.0	0.0	5.0	0.0	0.0	10.0
2003	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
2004	5.0	0.0	0.0	0.0	5.0	0.0	0.0	10.0
2005	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
2006	5.0	0.0	0.0	0.0	5.0	0.0	20.0	30.0
2007	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
TOTAL	55.0	40.0	40.0	100.0	45.0	60.0	40.0	380.0

Date of Downlisting: The year 2007, if all the recovery criteria are met.

TABLE OF CONTENTS

D.A. DOWN	Page
PART I:	
INTRODUCTION	1
Description	
Habitat	2
Autecology	2
Reproduction	3
Distribution	3
Likelihood of Persistence in Other Drainages	
Historic and Current Threats to the Species	
	-
PART II:	
RECOVERY	11
A. Recovery Objectives	
B. Narrative Outline	
C. Literature Cited	
PART III:	
IMPLEMENTATION SCHEDULE	21
IMPLEMENTATION SCREDULE	21
PART IV:	
LIST OF RECIPIENTS	24

PART I

INTRODUCTION

The palezone shiner (*Notropis albizonatus*) (Warren and Burr) (=N. sp., cf. procne) was listed as an endangered species on April 27, 1993 (U.S. Fish and Wildlife Service [Service] 1993). This small fish (60 mm long) occurs in large creeks and small rivers in the Tennessee and Cumberland River systems. Although the palezone shiner has been known to ichthyologists for at least 20 years (Snelson 1971, Comiskey and Etnier 1972, Jenkins 1976), little documentation has been forthcoming about its status or any aspect of its biology (Branson 1983).

Though the palezone shiner was likely once more widespread within the Tennessee and Cumberland River systems, it currently occurs in only two widely disjunct populations (Warren and Burr 1990, Warren et al. 1994)—the Paint Rock River (a Tennessee River tributary) in Jackson County, Alabama, and the Little South Fork of the Cumberland River in Wayne and McCreary Counties, Kentucky. Two other known populations are extirpated. Populations of this species have been fragmented by habitat alteration (primarily impoundments), and extant populations are being impacted by deteriorated water quality primarily resulting from poor land-use practices (e.g., agriculture and coal mining). The species' present limited distribution also makes it vulnerable to extirpation from stochastic events (Service 1993).

Description

The palezone shiner is an extremely slender, cylindrical minnow that reaches a maximum standard length of about 60 mm (Warren et al. 1994). Brief descriptions of the shiner, as well as illustrations, are presented by Starnes and Etnier (1980, half-tone), Branson (1983, half-tone), Ramsey (1986, color plate), and Etnier and Starnes (1993, color photo). This shiner has been referred to as the white-zone shiner (Comiskey 1970), paleband shiner (e.g., Jenkins et al. 1972, Jenkins and Sorenson 1980, Jandebeur and Chapman 1982, Stauffer et al. 1982, Ramsey et al. 1984, Feeman 1987), and palezone shiner (e.g., Comiskey and Etnier 1972, Starnes and Etnier 1980, Branson et al. 1981, Burr and Mayden 1981, Branson 1983, Burr and Warren 1986, Warren et al. 1986, Warren and Burr 1990, Warren et al. 1994).

The following description of the palezone shiner is summarized from a taxonomic description of the species provided by Warren et al. (1994). The most distinctive aspects of the species are characters of pigmentation. Chromatic breeding colors apparently do not develop, but specimens collected in late June had a faint wash of yellow at the base of the pectoral rays. General body coloration is a light, translucent straw color (quickly fading to paler opaque in preservative) with dark scale margins evident dorsally. The narrow, dark mid-lateral stripe, suffused by silver in life, runs over the lateral-line scale row onto the silvery operculum and becomes dusky or wanting postorbitally but continues

as a preocular bar and often encircles the snout as a discernible but dusky stripe on the upper lip and anterior snout. A dark, small basicaudal spot, often chevron- or wedge-shaped (apex forward), is present and is about as wide as, but slightly separated from, the mid-lateral stripe.

Extending the length of the body, just above and contrasting sharply with the mid-lateral stripe, is the "pale zone" or supralateral stripe, a broad and relatively pigmentless stripe about two scale rows in width, that is bordered dorsally by (and contrasts sharply with) the darkly pigmented margins of the scales on the dorsum. Dorsally, all scale margins are darkly outlined with melanophores, creating a "cross-hatched" effect anteriorly. The predorsal stripe is weakly developed or absent, and the postdorsal stripe is absent. The dark blotches before dorsal and caudal fins are noticeably darker than dorsalateral scale margins. Lateral line scales are usually 36 to 38; predorsal scale rows are usually 16 or 17.

Superficially similar syntopic species (i.e., mimic shiner [N. volucellus] and the undescribed sawfin shiner [N. sp. cf. spectrunculus]) can be distinguished from the palezone shiner by their deeper body, lack of the virtually unpigmented supralateral stripe (the "pale zone"), especially anteriorly, and a less intense mid-lateral mid-stripe; by having eight anal rays, anterior lateral-line scales elevated, and a well-developed predorsal stripe; and in the sawfin shiner, by having only the first four to five rays of the dorsal fin outlined with melanophores.

Habitat

The palezone shiner occurs in flowing pools and runs of upland streams that have permanent flow; clean, clear water; and substrates of bedrock, cobble, pebble, and gravel mixed with clean sand (Starnes and Etnier 1980, Branson and Schuster 1982, Burr and Warren 1986, Ramsey 1986). In May of 1990, Warren and Burr (1990) found the palezone shiner in the Paint Rock River (PRR) in slow to moderately flowing pools (60 to 75 cm in depth) over substrates of mixed sand, gravel, and cobble. In June of 1990, they collected the shiner (apparently in schools) in the Little South Fork of the Cumberland River (LSFCR) from shallow flowing pools (30 to 45 cm in depth), underlain by fractured bedrock and scattered patches of fine gravel. In August of 1990, they collected specimens in a different reach of the LSFCR from flowing pools and runs ranging in velocity from 0.6 to 4.5 cm/sec and a mean depth of 59 cm. Substrate varied from sand mixed with fine and coarse gravel to bedrock.

Autecology

Little is known of the autecology of the palezone shiner, other than its affinity for clean, clear, flowing large creeks and small rivers (Warren and Burr 1990) (also see comments in the "Habitat" and "Reproduction" sections of this recovery plan). The species is most

frequently associated with other shiners in both the LSFCR and PRR, including Cyprinella galactura, Luxilus chrysocephalus, Lythrurus ardens, Notropis boops (PRR only), N. telescopus, N. rubellus, N. volucellus (LSFCR only), and the sawfin shiner (N. sp. cf. spectrunculus). Collections examined contain at least three distinct size classes and suggest a longevity of 3 or perhaps 4 years. The species' food habits are unknown.

Reproduction

There is a paucity of information on reproduction in the palezone shiner (Warren et al. 1994) (see Raney [1947] for possible relevant breeding behavior in N. procne). Observations by Warren and Burr (1990) indicate that males and females mature at about 35 to 40 mm standard length. Tubercles are developed on breeding males by mid-May, and peak spawning condition apparently occurs in June but may last into early July; testes are not fully developed until June and are latent by early August, concomitant with the loss or reduction of tubercles. Females captured in mid-May through late June have extended abdomens and possess large cream- to yellow-colored ova; by early August, ovaries are transparent, and most ova are small and white to translucent. These observations indicate a spawning period from late May through June and perhaps early July. Other aspects of spawning behavior are unknown.

Distribution

The palezone shiner has been collected only from the LSFCR (Cumberland River drainage, Wayne and McCreary Counties, Kentucky); Marrowbone Creek (Cumberland River drainage, Cumberland County, Kentucky); the PRR (a Tennessee River tributary, Jackson County, Alabama); and Cove Creek, a Clinch River tributary (Tennessee River drainage, Campbell County, Tennessee).

The Warren and Burr collections from the spring (June) and summer (August) of 1990 indicate that the species presently occurs in the LSFCR, from about Freedom Church Ford upstream to 2 miles southwest of Parmleysville, Kentucky (Table 1). From available collection data over the past decade (including their 1990 survey), Warren and Burr judged that the species is most abundant in a 6-mile reach of the LSFCR, from about the mouth of Corder Creek downstream to Freedom Church Ford. Branson and Schuster (1982) collected over 500 specimens from the LSFCR, from river mile (RM) 5.4 (Freedom Church Ford) to RM 12.5 (Highway 92 bridge), with over 200 specimens taken at a single site (RM 9.1). The most upstream collection site reported is at the Highway 167 bridge (RM 35.2, 1 mile southwest of Mt. Pisgah, Wayne County, Kentucky). This report comes from a single specimen (identification unconfirmed) taken October 22, 1987 (M. M. Mills, Kentucky Division of Water, personal communication, 1990).

The approximate downstream limit of the species in the LSFCR is at or just below Freedom Church Ford (RM 5.4). The LSFCR, downstream of Freedom Church Ford, is flooded by the backwaters of Lake Cumberland at about RM 4.1 (corresponding to the location of Freedom Chapel), depending on the pool level in the reservoir. The backwaters eliminate the riffle and pool complexes characteristic of the upstream reaches of the river. Given the affinity of the shiner for flowing shallow pools, it is unlikely that

Table 1. Collecting localities and numbers collected of the palezone shiner in the Little South Fork Cumberland River, Wayne and McCreary Counties, Kentucky, from 1983 to 1990. Localities are arranged upstream to downstream; "NA" indicates no collections were made at that site or information is not available (from Warren and Burr 1990).

LOCALITY NUMBER	1980¹	1985²	1987³	1990 ⁴
1. Highway 167 bridge	NA	NA_	11_	0
2. 2 mi. SW of Parmleysville		NA	NA	9
3. Green Church Ford	NA	14	_NA	2
4. Mouth of Kennedy Creek	NA_	NA_	NA_	0
5. Highway 92 bridge	0	NA	1	1
6. RM 13.2	0	NA	NA	NA
7. Mouth of Corder Creek	5	<u>NA</u>	NA	NA_
8. RM 11.2	10	NA	NA	NA
9. Jones School Ford	9	_NA	132	5
10. RM 9.1	232	NA	NA_	NA_
11. Ritner Ford	83	5	67	22
12. RM 6.1	62	NA	NA	NA_
13. Freedom Church Ford	145	NA	30	94

¹Branson and Schuster 1982; ²C. F. Saylor, Tennessee Valley Authority, personal communication, 1990; ³Mills, personal communication, 1990; ⁴Warren and Burr 1990.

the palezone shiner is a permanent part of the ichthyofauna of the Lake Cumberland backwaters that inundate the lower 4.1 miles of the LSFCR.

The Marrowbone Creek record is based on a single specimen that was collected by R. Bailey and N. Wilimovsky on April 10, 1947, in Marrowbone Creek, at the mouth of Ferris Creek, Cumberland County, Kentucky (specimen confirmed by Burr [1980]) and by Burr and Warren [1986]). Based on a review of historic collection records by Warren and Burr (1990), the reach of Marrowbone Creek that yielded this specimen was resurveyed in 1956, 1965, 1972, 1979, 1981, and 1990 without revealing additional specimens. The single specimen recorded from the creek was taken about 3 years before the closure of Wolf Creek Dam to form Lake Cumberland (Henley 1967). Given the small size and extreme low flow of the creek (at least currently), the specimen may have represented a waif from a population that at that time resided in the lower reaches of the drainage (Warren and Burr 1990). Presently, the lowermost reaches of the creek are periodically embayed by cold tailwater releases from Wolf Creek Dam, inundating the species' potential habitat. Additionally, shade-producing riparian vegetation has been removed along much of the creek, and the watershed is deforested and highly agriculturalized (Warren and Burr 1990), potentially increasing sediment loading in the palezone shiner's habitat.

Within the PRR system, where the species was discovered only recently (Jandebeur and Chapman 1982, Feeman 1987), specimens have been collected from about RM 15 (from as far downstream as 1.3 miles northeast of Princeton, Alabama, and upstream to the town of Estill Fork on Estill Fork, Alabama [Table 2]).

Jandebeur and Chapman (1982) reported a total of 47 fish collections from stations located throughout the PRR drainage, but they collected the palezone only in this limited river reach. Collections by Warren and Burr (1990) both upstream and downstream of these localities did not reveal the species. Judging from their efforts and those of past surveys (Table 2), the palezone shiner occurs in greatest abundance from the lowermost reaches of Estill Fork and downstream in the PRR about 2 to 3 river miles.

The Cove Creek record is based on a single specimen collected by A. R. Cahn on November 21, 1936 (examined by Starnes and Etnier 1980 and Warren et al. 1994). Cove Creek is now impounded by Norris Dam to a depth of about 20 feet from the mouth upstream to the base of Cove Lake Dam. Above Cove Lake the creek is small and full of silt, and attempts to recollect the species in the drainage have been unsuccessful (D. A. Etnier, in litt. to R. E. Jenkins, July 16, 1968). The unimpounded headwaters of Cove Creek continue to be heavily impacted by surface mine run-off (Saylor, personal communication, 1990).

Likelihood of Persistence in Other Drainages

Warren and Burr (1990) reviewed collection records from other Tennessee and Cumberland River tributaries to assess the likelihood of the palezone shiner's persistence in other waters. The following is taken from their review of other pertinent collections.

Tennessee River Drainage: It is unlikely that the species persists in the Cove Creek drainage of the upper Clinch River, given impoundment and coal mining pollution within the watershed (Starnes and Etnier 1980; Saylor, personal communication, 1990). Recent surveys conducted by Tennessee Valley Authority biologists for endangered unionid mussels (e.g., Conradilla caelata [=Lemiox rimosus] and Quadrula intermedia) and their host fish, as well as to document the general "health" of river systems (Feeman 1980, 1986, 1987; Barr et al. 1986; Saylor et al. 1988), included many apparently suitable habitats for the palezone shiner within the Clinch River and Copper Creek, Powell River, North Fork Holston River, Nolichucky River, Emory River, Sequatchie River, Paint Rock

Table 2. Survey sites for the palezone shiner in the Paint Rock River, Jackson County, Alabama. Localities are arranged from upstream to downstream and, unless otherwise indicated, were surveyed in May and/or August 1990 (from Warren and Burr 1990).

LOCALITY NUMBER	NUMBER OF PALEZONE SHINERS
1. Estill Fork at the junction of County Roads 140 and 9	00
2. Estill Fork at the town of Estill Fork	20
Paint Rock River at its confluence with Hurricane Creek and Estill Fork	21*
4. Paint Rock River at a ford off County Road 9, ca. 1 mi SSW of the town of Estill Fork	42
5. Paint Rock River, ca. 0.6 mi S of Swaim	2**
6. Larkin Fork, 0.9 mi NNW of Swaim	1***
7. Paint Rock River, ca. 1.3 mi. NE of Princeton	6***
8. Paint Rock River, ca. 0.75 mi S of Princeton	0
9. Paint Rock River, ca. 1.5 mi S of Hollytree	0
10. Paint Rock River at a ford off Highway 65, 1.4 road miles SSW of Trenton	0
11. Paint Rock River at the town of Paint Rock	0

^{*}Data from Feeman (1987, 15 specimens collected in 1981) and from the University of Alabama Ichthyological Collection (UAIC, 6 specimens collected in 1980).

^{**}Data from UAIC (collected in 1980).

^{***}Data from T. S. Jandebeur (Athens College, personal communication, 1990).

^{****}Data from UAIC (collected in 1981).

River, Elk River, Bear Creek, Buffalo River, and Duck River. Nevertheless, these surveys revealed the palezone shiner only from the PRR. Other efforts in potential habitat within the Tennessee River drainage that did not reveal palezone shiners include Etnier et al. (1981), Chickamauga, Chattanooga, and Lookout Creeks; Jandebeur (1972), Elk River; Anonymous (1968a, 1968b, 1969, 1970, 1972), Powell, Emory, Flint, Sequatchie, and Duck Rivers, respectively; and Nieland (1979), Duck River. In addition, the sorting and identification of preimpoundment fish collections made in the Tennessee River valley from 1937 to 1943 failed to reveal a single palezone shiner (Etnier et al. 1979). Warren and Burr (1990) also surveyed several potential sites (Saylor, personal communication, 1990) within the Flint River drainage in Alabama, a system immediately west of the PRR, without discovering the palezone shiner. Thus, within the Tennessee River drainage, Warren and Burr (1990) believe that few if any other populations persist aside from that documented for the PRR.

Cumberland River Drainage: Within the Cumberland River drainage of eastern Kentucky, Comiskey (1970) (summarized in Comiskey and Etnier 1972) surveyed the Big South Fork Cumberland River and noted the restriction of the palezone shiner to the LSFCR. O'Bara et al. (1982) surveyed 16 streams within the Big South Fork (excluding LSFCR), but did not record the palezone shiner. Harker et al. (1979 and 1980) surveyed sites in several streams affording potential habitat for the species in the Cumberland River drainage of Kentucky, including Rockcastle River, LSFCR, Rock Creek, the main stem of the Big South Fork River, Laurel River, Buck Creek, and other tributaries both above and below Cumberland Falls (e.g., Marsh, Pitman, Meshack, Fishing, and Sulfur Creeks). However, they reported the palezone shiner only from the LSFCR. Warren et al. (1983) summarized lists of Kentucky State Nature Preserves Commission fish collections (1978 to 1981) from the Cumberland River of Kentucky (some previously unreported), including a station on Marrowbone Creek, but the species was documented only from the LSFCR. Given the attempts to recollect the species in Marrowbone Creek (see the "Distribution" section of this recovery plan), Warren et al. (1994) believe it no longer occurs in this stream.

Other surveys within the Cumberland River conducted in likely habitat but not revealing the palezone shiner include: B. M. Burr and former students (various streams from the upper Cumberland downstream to and including the Red River, Southern Illinois University at Carbondale collection records; also Shepard and Burr 1984); D. A. Etnier and former students (various streams, including the Obey, Caney Fork, Stones, Red, and Harpeth Rivers, University of Tennessee collection records); Cicerello and Butler (1985, Buck Creek); R. J. DiStefano (Missouri Department of Conservation, personal communication, 1980; Horse Lick Creek and Rockcastle River); Branson and Batch (1972, Clear Creek and Rockcastle River); and Small (1970, Rockcastle River).

As judged from collecting efforts and the known post-1960 distribution of the palezone shiner, it is believed that this fish is now restricted to two small river systems—the LSFCR and PRR—both of which represent remnants of lotic systems that, at least until recently, retained physical and biotic characteristics exemplary of the prehistoric norm (Warren and Burr 1990).

Historic and Current Threats to the Species

The endemism of the palezone shiner in the upper Cumberland (below the Falls) and Tennessee River systems is shared with several other fishes (Burr and Warren 1986, Starnes and Etnier 1986). Of the exclusively shared species between the two systems, several, including the palezone shiner, occur in only a few of the most diverse and relatively clean riverine habitats; these same habitats often contain other aquatic species that receive State or Federal conservation status (e.g., *Pegias fabula* and *Villosa trabilis*).

Three of the four known localities for the palezone shiner (except Marrowbone Creek) and both extant populations (LSFCR and PRR) occur in streams on the periphery of the Cumberland Plateau. The distribution of the palezone shiner implies that the two remaining populations are remnants of a once more widespread distribution (Starnes and Etnier 1986). Thus, two alternate, but not mutually exclusive, explanations may be relevant concerning the highly fragmented range of the palezone shiner--(1) the species is relatively ancient and extirpation has occurred prehistorically over much of its range or (2) the extirpation of populations over much of the range has occurred in historic times as a result of the loss or degradation of appropriate habitat from siltation, inadequate in-stream flow, reservoir construction, channelization, and coal mining run-off (Warren and Burr 1990).

The elimination of the species from the Cove Creek drainage within recent times is exemplary of the effect of reservoir construction and coal mining pollution on an obligate stream species (Starnes and Etnier 1980). Unfortunately, the lack of extensive preimpoundment surveys in both the Tennessee and Cumberland River systems precludes assessment of the historical distribution of the palezone shiner, but loss of other species as a result of impoundments in these systems is well documented (e.g., Etnier *et al.* 1979).

The lower portions of most large tributaries in both the Tennessee and Cumberland Rivers are embayed, eliminating habitat transition between that of small streams and rivers. Reservoirs also effectively eliminate migration by obligate stream fishes from one tributary to another, precluding natural colonization of potentially suitable streams by the palezone shiner (Warren and Burr 1990). The mouth of the LSFCR is embayed by the Cumberland Reservoir and the PRR by the Wheeler Reservoir. Other species have disappeared from various tributaries since impoundment, such as the ashy darter (Etheostoma cinereum) in Buck Creek, of the Cumberland River system, which, despite

intensive collecting efforts, has not been taken there since 1955, or about 4 years after impoundment of the Cumberland Reservoir (Shepard and Burr 1984, Cicerello and Butler 1985). Marrowbone Creek empties into the Cumberland River below Wolf Creek Dam. The dam discharge consists of extremely cold, hypolimnetic waters from the Cumberland Reservoir, which effectively impounds the lower reaches of the creek depending on the extent and duration of release schedules. Collecting in the main stem of the Cumberland River (and the lowermost reaches of tributaries) at and well below the dam indicates a depauperate native ichthyofauna (Warren and Cicerello 1983), primarily a function of the cold-water releases and irregular water level fluctuations below dams.

Other probable historic reasons that may have restricted the distribution of the palezone shiner include the removal of shade-producing riparian vegetation and the concomitant increase in maximum stream temperatures, channelization, increased siltation associated with poor agricultural and mining practices, deforestation of watersheds and the concomitant decreases in in-stream low flow, and perhaps pesticide run-off (Warren and Burr 1990).

Since about 1980, the lower third of the LSFCR (about 15 RM) has been periodically subjected to toxic surface mine run-off (especially, elevated heavy metal concentrations) that all but eliminated the mussel fauna from the lower third of the river (Anderson 1989). The impact of the discharge on the palezone shiner within this reach of the river is unknown, but recent (1990) sampling in this reach (Warren and Burr 1990) compared to past efforts (e.g., Harker et al. 1979, 1980; Branson and Schuster 1982) indicates the benthic fish community, both in terms of diversity and numbers of individuals, has been severely reduced, a probable result of the direct mortality of adults and/or eggs, larvae, and juveniles. Warren and Burr (1990) concurred with Anderson (1989), who concluded that current surface mine regulations may be inadequate to protect the mussel fauna of the LSFCR and added that, if the toxic discharge is not curtailed, much of the aquatic fauna of the LSFCR, including the palezone shiner, is imperiled. Upstream of the area receiving toxic mine discharge in the LSFCR, the primary threats to the palezone shiner are brine discharges from oil wells (Harker et al. 1979, 1980) and poor land-use practices associated with increased siltation of the stream (e.g., road building, deforestation, and destruction of riparian buffer strips) (Warren and Burr 1990).

Within the PRR, the continued existence of the species will depend upon the continued high water quality present from about Princeton, Alabama, upstream into the headwaters in Tennessee. The limited distribution of the species within the PRR definitely appears correlated with increasing agriculture and an associated increase in stream siltation in the reaches below Princeton. Ramsey (1986) noted that the Paint Rock River was channelized by the U.S. Army Corps of Engineers in 1966 (project initiated in 1962, completed in 1966; Jandebeur, personal communication, 1990), but the impacts on the palezone shiner are unknown because no surveys were conducted prior to channelization.

Because existing palezone shiner populations inhabit short river reaches, they are vulnerable to extirpation from stochastic events, such as accidental toxic chemical spills. Because of the palezone's relatively short life span, the species is extremely vulnerable to short-term and/or localized habitat alterations. In addition, as the populated stream reaches are isolated from each other and from any potential unoccupied habitat by impoundments, recolonization of any extirpated population would not be possible without human intervention. The absence of natural gene flow between palezone populations leaves the long-term genetic viability of these isolated populations in question.

PART II

RECOVERY

A. Recovery Objectives

The ultimate goal of this recovery plan is to restore viable populations* of the palezone shiner (*Notropis albizonatus*) throughout a significant portion of its historic range and remove the species from the Federal List of Endangered and Threatened Wildlife and Plants.

*Viable population - A reproducing population that is large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural habitat changes. The number of individuals needed and the amount and quality of habitat required to meet this criterion will be determined for the species as one of the recovery tasks.

Criteria for Downlisting to Threatened Status:

The species will be considered for reclassification to threatened status when the likelihood of the species' becoming extinct in the foreseeable future has been eliminated by achievement of the following criteria:

- 1. Through protection and enhancement of the existing populations, a viable population* of the palezone shiner exists in the LSFCR and PRR.
- 2. Studies of the fish's biological and ecological requirements have been completed, and the implementation of management strategies developed from these studies have been successful in increasing the number and range of the palezone shiner in the LSFCR and PRR.
- 4. No foreseeable threats exist that would likely threaten the survival of a significant portion of the species' range in either the LSFCR or PRR.

Criteria for Delisting:

The final step in the recovery process would be to remove the palezone shiner from the Endangered Species Act's protection. However, it may not be possible to accomplish recovery for this species. The species was historically known from only four rivers and/or creeks. Two of these populations are extirpated, and it is unlikely that the species can be successfully reintroduced into either of these creeks. Thus, unless other historic habitat can be located and repopulated or other existing populations are found, it will be difficult to protect and expand the existing populations to the point where recovery can be achieved.

B. Narrative Outline

- 1. Preserve present population and presently used habitat. Because only two populations exist, it is critical for the survival of the species that these populations be protected.
 - 1.1 Continue to use existing legislation and regulations (Federal Endangered Species Act, Federal and State surface mining laws, water quality regulations, stream alteration regulations, Federal Energy Regulatory Commission licensing, etc.) to protect the fish and its habitat. Prior to and during implementation of this recovery plan, the species and its habitat should be protected with the full implementation and enforcement of existing Federal and State laws and regulations.
 - 1.2 Solicit help in protecting the species and its essential habitat through the development of cooperation and partnerships (e.g., Wheeler-Elk River Action Team) with Federal and State agencies, local governments, farming groups, coal mining interests, conservation organizations, and local landowners and individuals. Section 7 consultation under the Endangered Species Act and Fish and Wildlife Coordination Act activities can assist in the protection of the species, but these programs alone cannot recover the palezone shiner. The assistance of Federal and State agencies and local governments will be essential. However, more importantly, the support of the local farming community and mining interests, as well as local individuals and landowners, will be essential in order to meet these recovery goals. Without a partnership with the people who live and work in these watersheds and who have an influence on habitat quality, recovery efforts will be doomed.
 - 1.2.1 Meet with local government officials and regional and local planners to inform them of plans to attempt recovery and request their support.
 - 1.2.2 Meet with farming, timber, and coal mining interests and try to elicit their support in implementing protective actions.
 - 1.2.3 Develop cooperative ventures with private landowners to restore riparian habitat through programs like Partners for Wildlife. The Service, in cooperation with landowners, has begun to implement programs to restore riparian habitat and control agricultural run-off in other streams in the Southeastern United States. Such programs should be pursued to help minimize soil erosion and enhance palezone shiner habitat. The Tennessee Valley Authority, through the actions of their Elk-Paint Rock River Action Team, is actively involved with many other Federal, State, and local partners in the protection and restoration of the Paint Rock River system.

- 1.2.4 Develop an educational program using items such as slide/tape programs, brochures, etc. Present this material to schools, farmers, civic groups, youth groups, church organizations, etc. Educational material outlining the recovery goals, with emphasis on the other benefits of maintaining and upgrading habitat quality, will be extremely useful in informing the public of recovery actions.
- 1.3 Determine threats to the species, conduct research necessary for the species' management and recovery, and implement management where needed.
 - 1.3.1 Conduct life history research on the species to include such factors as reproduction, food habits, age and growth, and mortality.

 Warren and Burr (1990) provided some information on the life history of the palezone shiner. However, additional life history information will be needed to implement recovery. Whenever possible, studies should be accomplished without sacrificing any palezone shiners.
 - 1.3.2 Characterize the species' habitat (relevant physical, biological, and chemical components) for all life history stages. The palezone shiner has been able to withstand some degree of habitat degradation. However, some habitat has been so severely altered that the species was extirpated from some streams and other population segments are reduced in size and vigor. Knowledge of the species' specific microhabitat requirements and ecological associations is needed to focus management and recovery efforts on the specific problems within the species' habitat.
 - 1.3.3 Determine present and foreseeable threats to the species. Siltation from some farming and logging practices and toxic run-off and siltation from coal mining activities have contributed and continue to contribute to substrate and water quality degradation. In addition, cold hypolimnetic waters from nearby impoundments make habitat in the lower LSFCR uninhabitable by the palezone shiner. The mechanisms by which the species and its habitat are impacted by these factors are not entirely understood, and the extent to which the species can withstand the impacts of silt is not known. Other environmental factors impacting the species also need to be understood.
 - 1.3.4 Based on the biological data and threat analysis, investigate the need for management, including habitat improvement. Implement management, if needed, to secure a viable population. Specific components of the species' habitat may be lacking and limiting the species' potential expansion, or certain activities in the watershed may be adversely impacting the species. Habitat improvement programs may be needed to increase spawning success. Structures may be needed

to provide cover and stabilize the stream bank and streambed. Cooperative efforts will be needed to overcome some of the threats identified in Task 1.3.3.

- 1.3.5 Determine the number of individuals required to maintain a long-term viable population. Inbreeding depression can be a major obstacle to the recovery of the species, especially if the remaining population size is small and/or it has gone through some type of genetic bottleneck. The actual number of individuals in a population is not necessarily a good indication of a population's genetic viability; rather, the "effective population" size is important. The effective population size is the size of an "ideal" population in which genetic drift takes place at the same rate as in the actual population (Chambers 1983). Franklin (1980) suggested that the inbreeding coefficient should be limited to no more than 1 percent per generation, a figure which implies that the short-term, maintenance effective-population-size should be no fewer than 50 individuals (Frankel and Soulé 1981, Franklin 1980, Soulé 1980). Because the effective population size is typically only one-third to one-forth the actual population size (being affected by sex ratio, overlapping generations, generally nonrandom distribution of offspring, and nonrandom mating) (Soulé 1980), a population of 150 to 200 individuals is needed for short-term population maintenance. Soulé (1980) further suggests that for long-term viability, an effective population of 500 individuals is necessary, translating into a population size of 1,500 to 2,000 individuals. The effective population size of the palezone shiner population needs to be determined in order to calculate whether this population is capable of long-term self-maintenance or whether a breeding program should be initiated. Some of these factors can be addressed under Task 1.3.3, while others will be addressed as needed.
- 2. Search for additional populations and/or habitat suitable for reintroduction efforts. The Tennessee and Cumberland River systems have been surveyed extensively. However, it is possible that some small palezone shiner populations were missed. Further study in possible suitable habitat may reveal additional populations and suitable unoccupied habitat for transplants.
- 3. Determine the feasibility of reestablishing the palezone shiner into historic habitat and reintroduce where feasible. The exact historic range of the palezone shiner is unknown. However, based on historic collection records, the species has been taken from four rivers/creeks (Warren and Burr 1990). The species has been extirpated from two areas, and because of significant habitat deterioration, it is unlikely that the fish can be reintroduced into either of these streams. (See description of factors causing the loss of these populations in the Distribution section). However, other streams may exist within the species' historic range that may be suitable for reintroduction. If such streams exist, they should be assessed

to determine the likelihood that they were historic habitat and the potential for reintroduction success. Based on this review and discussions with appropriate State, Federal, and local government entities, determine if reintroduction efforts are appropriate. Also, consider the need to augment existing populations through introductions.

- 3.1 Develop successful techniques for reestablishing populations. If it is determined that reintroduction into historic habitat is an appropriate management tool for palezone shiner recovery and sufficient stock of the palezone shiner is not available to allow for the removal of enough adults to reestablish populations or expand the species' range in existing habitat, consider developing propagation techniques for the palezone shiner.
- 3.2 If appropriate and necessary, reintroduce the species into its historic range and evaluate success. Using the techniques developed in Task 3.1, reintroduce the palezone shiner into areas where it has been extirpated and into other areas to expand the range of existing populations. Monitor the progress of the transplants.
- 3.3 Implement the same protective measures for any introduced populations as outlined for established population segments.
- 4. Develop and implement a program to monitor population levels and habitat conditions of currently existing population segments as well as any newly discovered, introduced, or expanded population segments. During and after recovery actions are implemented, the status of the species and its habitat must be monitored to assess any progress toward recovery. This should be conducted on a biennial schedule.
- 5. Annually assess the overall success of the recovery program and recommend action (changes in recovery objectives, delist, continue to protect, implement new measures, other studies, etc.). The recovery plan must be evaluated periodically to determine if it is on track and to recommend future actions. As more is learned about the species, the recovery objectives may need to be modified.

C. Literature Cited

- Anderson, R. M. 1989. The effect of coal surface mining on endangered freshwater mussels (Molluska: Unionidea) in the Cumberland River drainage. Masters thesis, Tennessee Technological University, Cookeville, TN.
- Anonymous. 1968a. Tennessee Valley streams: their fish, bottom fauna, and aquatic habitat, Powell River drainage basin. Tennessee Valley Authority, Norris, TN.
- ----. 1968b. Tennessee Valley streams: their fish, bottom fauna, and aquatic habitat, the Emory River. Tennessee Valley Authority, Norris, TN.
- -----. 1969. Tennessee Valley streams: their fish, bottom fauna, and aquatic habitat, Flint River drainage basin. Tennessee Valley Authority, Norris, TN.
- -----. 1970. Tennessee Valley streams: their fish, bottom fauna, and aquatic habitat, Sequatchie River drainage basin. Tennessee Valley Authority, Norris, TN.
- ----- 1972. Tennessee Valley streams: their fish, bottom fauna, and aquatic habitat, Duck River drainage basin. Tennessee Valley Authority, Norris, TN.
- Barr, W. C., S. A. Ahlstedt, G. D. Hickman, and D. M. Hill. 1986. Cumberlandian mollusk conservation program. Activity 8: analysis of macrofauna factors. TVA/ONRED/AWR-86/22, Tennessee Valley Authority, Knoxville, TN.
- Branson, B. A. 1983. Observations on the palezone and sawfin shiners, two undescribed cyprinid fishes from Kentucky. Transactions of the Kentucky Academy of Science 44(3-4):103-106.
- Branson, B. A., and D. L. Batch. 1972. Fishes of Clear Creek, tributary to Rockcastle River, Kentucky. Transactions of the Kentucky Academy of Science 33:33-35.
- Branson, B. A., and G. A. Schuster. 1982. The fishes of the wild river section of the Little South Fork of the Cumberland River, Kentucky. Transactions of the Kentucky Academy of Science 43(1-2):60-70.
- Branson, B. A., D. F. Harker, Jr., J. M. Baskin, M. E. Medley, D. L. Batch, M. L. Warren, Jr., W. H. Davis, W. C. Houtcooper, B. Monroe, Jr., L. R. Phillippe, and P. Cupp. 1981. Endangered, threatened, and rare animals and plants of Kentucky. Transactions of the Kentucky Academy of Science 42(3-4):77-89.
- Burr, B. M. 1980. A distributional checklist of the fishes of Kentucky. Brimleyana No. 3:53-84.

- Burr, B. M., and R. L. Mayden. 1981. Systematics, distribution, and life history notes on *Notropis chihuahua* (Pisces: Cyprinidae). Copeia 1981:255-265.
- Burr, B. M., and M. L. Warren, Jr. 1986. A distributional atlas of Kentucky fishes. Kentucky State Nature Preserves Commission Scientific and Technical Series No. 4.
- Chambers, S. M. 1983. Genetic principles for managers. Pp. 44-45. *In*:
 C. S. Schonewald-Cox, S. M. Chambers, B. MacBryde, and W. Thomas (eds.). 1983. Genetics and Conservation A reference for managing wild animal and plant populations. The Benjamin/Cummings Publ. Co., Inc., New York, NY. 722 pp.
- Cicerello, R. R., and R. S. Butler. 1985. Fishes of Buck Creek, Cumberland River drainage, Kentucky. Brimleyana 11:133-159.
- Comiskey, C. E. 1970. The fishes of the Big South Fork of the Cumberland River system. Unpublished masters thesis, University of Tennessee, Knoxville, TN.
- Comiskey, C. E., and D. A. Etnier. 1972. Fishes of the Big South Fork of the Cumberland River. Journal of the Tennessee Academy of Science 47(4):140-145.
- Etnier, D. A., and W. C. Starnes. 1993. The fishes of Tennessee. University of Tennessee Press, Knoxville, TN. 681 pp.
- Etnier, D. A., W. C. Starnes, and B. H. Bauer. 1979. Whatever happened to the silvery minnow (*Hybognathus hayi*) in the Tennessee River? Southeastern Fishes Council Proceedings 2(3):1-3.
- Etnier, D. A., B. H. Bauer, and A. G. Haines. 1981. Fishes of the Gulf Coastal drainage of north Georgia (Part I) and fishes of Chickamauga, Chattanooga, and Lookout Creeks, north Georgia and Tennessee (Part II). Unpublished report provided by authors.
- Feeman, J. C. 1980. A quantitative survey of the fish and macroinvertebrates of the Holston River basin: August-September 1973. Report No. WR(FO)40-4-80.1. Tennessee Valley Authority, Norris, TN.
- -----. 1986. Fishes of the North Fork Holston River system, Virginia and Tennessee. Proceedings of the Southeastern Fishes Council 4(4).
- ----. 1987. Results of fish surveys in the Tennessee River drainage, 1979-1981. Brimleyana No. 13:99-121.

- Frankel, O. H., and M. E. Soulé. 1981. Conservation and Evolution. Cambridge Univ. Press. England.
- Franklin, R. I. 1980. Evolutionary change in small populations. Pp. 135-149.

 In: Conservation biology, an evolutionary-ecological perspective. Michael E. Soulé and Bruce A. Wilcox (eds.). Published by Sinauer Assoc., Inc., Sunderland, MA. Pp. 135-149.
- Harker, D. F., Jr., S. M. Call, M. L. Warren, Jr., K. E. Camburn, and P. Wigley. 1979. Aquatic biota and water quality of the Appalachian Province, eastern Kentucky. Kentucky State Nature Preserves Commission Technical Report, Frankfort, KY.
- Harker, D. F., Jr., M. L. Warren, Jr., K. E. Camburn, S. M. Call, G. J. Fallo, and
 P. Wigley. 1980. Aquatic biota and water quality of the upper Cumberland
 River basin. Kentucky State Nature Preserves Commission Technical Report,
 Frankfort, KY.
- Henley, J. P. 1967. Lake Cumberland investigations. Kentucky Department of Fish and Wildlife Resources, Fisheries Bulletin 28:1-26.
- Jandebeur, T. S. 1972. A study of the fishes of the Elk River drainage system in Tennessee and Alabama. Unpublished masters thesis, University of Alabama, Tuscaloosa, AL.
- Jandebeur, T. S., and M. G. Chapman. 1982. A report on the fishes of the Paint Rock River system in Alabama. Association of Southeastern Biologists Bulletin 29(2):66-67.
- Jenkins, R. E. 1976. A list of undescribed freshwater fish species of the continental United States and Canada, with additions to the 1970 checklist. Copeia 1976(3):642-644.
- Jenkins, R. E., and D. S. Sorensen. 1980. *Notropis procne* (Cope), swallowtail shiner, p. 298. *In*: D. S. Lee *et al.* (eds.). Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh, NC.
- Jenkins, R. E., E. A. Lachner, and F. J. Schwartz. 1972. Fishes of the central Appalachian drainages: their distribution and dispersal, pp. 43-117. *In*: P. G. Holt (ed.). The distributional history of the biota of the Southern Appalachians. Part III: vertebrates. Research Division Monograph 4, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- Nieland, D. L. 1979. Fishes of the Duck River. Association of Southeastern Biologists Bulletin 26(2):67.

- O'Bara, C. J., W. L. Pennington, and W. P. Bonner. 1982. A survey of water quality, benthic macroinvertebrates, and fish for 16 streams within the Big South Fork National River and Recreation Area. U.S. Army Corps of Engineers Contract No. DACW62-81-C-0162, Nashville, TN.
- Ramsey, J. S. 1986. Paleband shiner, *Notropis* sp. cf. *procne*, pp. 6-7. *In*:

 R. H. Mount (ed.), vertebrate animals in Alabama in need of special attention.

 Alabama Agricultural Experiment Station, Auburn University, Auburn, AL.
- Ramsey, J. S., H. T. Boschung, W. M. Howell, T. S. Jandebeur, M. F. Mettee, R. D. Nester, P. E. O'Neil, M. Pierson, W. C. Reeves, R. A. Stiles, and W. Wieland. 1984. Freshwater fishes, pp. 1-14. *In*: R. H. Mount (ed.), vertebrate wildlife of Alabama. Alabama Agricultural Experiment Station, Auburn University, Auburn, AL.
- Raney, E. C. 1947. Subspecies and breeding behavior of the cyprinid fish *Notropis* procne (Cope). Copeia 1947(2):103-109.
- Saylor, C. F., G. D. Hickman, and M. P. Taylor. 1988. Application of index of biotic integrity (IBI) to fixed station water quality monitoring sites 1987. TVA/RD/SM-88/2, Tennessee Valley Authority, Norris, TN.
- Shepard, T. E., and B. M. Burr. 1984. Systematics, status, and life history aspects of the ashy darter, *Etheostoma cinereum* (Pisces: Percidae). Proc. Biol. Soc. Wash. 97:693-715.
- Small, J. W., Jr. 1970. A study of the fish fauna of the Rockcastle River basin of Kentucky with comments on the effect of strip mine pollution. Unpublished masters thesis, University of Kentucky, Lexington, KY.
- Snelson, F. F., Jr. 1971. Notropis mekistocholas, a new herbivorous cyprinid fish endemic to the Cape Fear River basin, North Carolina. Copeia 1971(3):449-462.
- Soulé, M. E. 1980. Thresholds for survival: maintaining fitness and evolutionary potential. Ch. 8, pp. 151-169. *In*: Conservation biology, an evolutionary perspective. Michael E. Soulé and Bruce A. Wilcox (eds.). Published by Sinauer Assoc., Inc., Sunderland, MA.
- Starnes, W. C., and D. A. Etnier. 1980. Fishes, pp. B1-B134. *In*: D. C. Eager and R. M. Hatcher (eds.). Tennessee's rare wildlife, Volume I: the vertebrates. Tennessee Wildlife Resources Agency and Tennessee Heritage Program, Nashville, TN.

- -----. 1986. Drainage evolution and fish biogeography of the Tennessee and Cumberland Rivers drainage realm, pp. 325-361. *In*: C. H. Hocutt and E. O. Wiley (eds.). The zoogeography of North American freshwater fishes. John Wiley and Sons, New York, NY.
- Stauffer, J. R., Jr., B. M. Burr, C. H. Hocutt, and R. E. Jenkins. 1982. Checklist of the fishes of the central and northern Appalachian Mountains. Proceedings of the Biological Society of Washington 95:27-47.
- U.S. Fish and Wildlife Service. 1993. Endangered and threatened Wildlife and Plants; determination of the palezone shiner (*Notropis* sp., cf. *procne*) to be an endangered species. *Federal Register* 58(79):25758-25763.
- Warren, M. L., and B. M. Burr. 1990. Status of the palezone shiner (*Notropis* sp., cf. *procne*), a Federal candidate for listing. Unpubl. Report to the U.S. Fish and Wildlife Service, Asheville, NC. 27 pp.
- Warren, M. L., B. M. Burr, and J. M. Grady. 1994. *Notropis albizonatus*, a new cyprinid fish endemic to the Tennessee and Cumberland River drainage, with phylogeny of the *Notropis procne* species group. Copeia 1994(4):868-886.
- Warren, M. L., Jr., and R. R. Cicerello. 1983. Drainage records and conservation status evaluations for 13 Kentucky fishes. Brimleyana 9:97-109.
- Warren, M. L., Jr., K. E. Camburn, and R. R. Cicerello. 1983. Fish collection catalog of the Kentucky State Nature Preserves Commission (1978-1981). Kentucky State Nature Preserves Commission, Frankfort, KY.
- Warren, M. L., Jr., W. H. Davis, R. R. Hannan, M. Evans, D. L. Batch, B. D. Anderson, B. Palmer-Ball, Jr., J. R. MacGregor, R. R. Cicerello, R. Athey, B. A. Branson, G. J. Fallo, B. M. Burr, M. E. Medley, and J. M. Baskin. 1986. Endangered, threatened, and rare plants and animals of Kentucky. Transactions of the Kentucky Academy of Science 47(3-4):83-98.

PART III

IMPLEMENTATION SCHEDULE

Priorities in column 1 of the following Implementation Schedule are assigned as follows:

- 1. Priority 1 An action that <u>must</u> be taken to prevent extinction or to prevent the species from declining irreversibly in the <u>foreseeable</u> future.
- 2. Priority 2 An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- 3. Priority 3 All other actions necessary to meet the recovery objective.

Key to Acronyms Used in This Implementation Schedule

- ES Ecological Services Division, U.S. Fish and Wildlife Service.
- FA Other Federal Agencies Includes the Tennessee Valley Authority, U.S. Natural Resources Conservation Service, U.S. Forest Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and Office of Surface Mining.
- FWS U.S. Fish and Wildlife Service
- LE Law Enforcement Division, U.S. Fish and Wildlife Service
- R4 Region 4 (Southeast Region), U.S. Fish and Wildlife Service
- SCA State Conservation Agencies Includes the Kentucky Department of Fish and Wildlife Resources, Kentucky State Nature Preserves Commission, Alabama Division of Game and Fish, Alabama Department of Conservation and Natural Resources, Alabama Natural Heritage Program, and Geological Survey of Alabama.
- TNC The Nature Conservancy

Comments 5.0 20.0 20.0 20.0 5.0 5.0 5.0 Cost Estimates (\$000s) 20.0 20.0 5.0 5.0 5.0 5.0 FY2 : 20.0 15.0 20.0 5.0 5.0 5.0 FYI i IMPLEMENTATION SCHEDULE FA, SCA, TNC Responsible Agency Other FA, SCA FWS and LE R4/ES R4/ES R4/ES R4/ES R4/ES R4/ES R4/ES 1 year (then continuous) Continuous Continuous Duration Task 3 years 3 years 3 years l year Develop programs like "Partners for Wildlife" with willing landowners Develop information and education program and present. Continue to use existing legislation management and implement where needed. species management and recovery; i.e., habitat requirements, biology, and threat analysis. Solicit help in the protection and conservation of the species and its Determine number of individuals and regulations to protect species and its habitat. Conduct research necessary for Based on biological and threat to protect and improve habitat analysis, investigate need for required to maintain viable Task Description population. quality. habitat. Number Task 1.2.1, 1.2.4 1.3.1, 1.3.2, 1.3.3 1.3.4 1.3.5 1.2.3 Priority

20.0 2.0 0.5 FY3 į Cost Estimates (\$000s) 20.0 20.0 0.5 FY2 i 20.0 2.0 0.5 FY1 i IMPLEMENTATION SCHEDULE FA, SCA, TNC FA, SCA, TNC FA, SCA, TNC FA, SCA, TNC Responsible Agency Other FWS R4/ES R4/ES R4/ES R4/ES Continuous Task Duration Biennial 3 years 1 year Develop techniques, select sites, reintroduce the species back into historic habitat, and evaluate and protect any populations established. Annually assess recovery program and modify program and plan where required. Search for additional populations Task Description Develop and implement a monitoring program. and suitable habitat. Task Number

~

~

~

~

3

Priority

Comments

PART IV

LIST OF RECIPIENTS

The following agencies, organizations, and individuals were mailed copies of this recovery plan. This does not imply that they provided comments or endorsed the contents of this plan.

County Executive Jackson County Courthouse Scottsboro, Alabama 35768

Director
Division of Water
Kentucky Natural Resources and
Environmental Protection Cabinet
5th Floor, Capital Plaza Tower
Frankfort, Kentucky 40601

Director
Office of Hydropower Licensing
Federal Energy Regulatory Commission
825 North Capitol Street, NE.
Washington, DC 20426

Superintendent
Big South Fork National River and
Recreation Area
Route 3, Box 401
Oneida. Tennessee 37841-9544

Lt. Col. John Whisler
Nashville District Engineer
U.S. Army Corps of Engineers
P.O. Box 1070
Nashville, Tennessee 37202-1070

District Engineer
Mobile District
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628-0001

Rural Economic and Community
Development Service
4121 Carmichael Road, Suite 601
Sterling Center Building
Montgomery, Alabama 36106-3683

Federal Highway Administration 500 Eastern Boulevard, Suite 200 Montgomery, Alabama 36117

Division Administrator Federal Highway Administration P.O. Box 536 Frankfort, Kentucky 40602-0536

Division Administrator Federal Highway Administration 249 Cumberland Bend Drive Nashville, Tennessee 37228

Alabama State Programs Administrator Room 279 Industrial Relations Building Montgomery, Alabama 36130

Farm Service Agency P.O. Box 235013 Montgomery, Alabama 36123-5013

Geologist/Oil and Gas Supervisor Geological Survey of Alabama P.O. Drawer 0 University, Alabama 35486

Alabama Forestry Association 600 Adams Avenue, Suite 101 Montgomery, Alabama 36104

Dr. Brooks Burr Department of Zoology Southern Illinois University Carbondale, Illinois 62901-6501

The Nature Conservancy 2821 2nd Avenue, South, #C Birmingham, Alabama 35233-2811 U.S. Natural Resources Conservation Service P.O. Box 33 Auburn, Alabama 36830

Mr. Bill Milliken U.S. Natural Resources Conservation Service 771 Corporate Drive, Suite 110 Lexington, Kentucky 40503

Mr. Jerry Lee U.S. Natural Resources Conservation Service U.S. Courthouse, Room 675 801 Broadway Nashville, Tennessee 37203

Mr Charles D. Kelley, Director
Division of Game and Fish
Alabama Department of Conservation and
Natural Resources
64 N. Union Street
Montgomery, Alabama 36130

Mr. James D. Martin, Commissioner
Alabama Department of Conservation and Natural Resources
64 N. Union Street
Montgomery, Alabama 36130

Alabama Highway Department Environmental Section 1409 Coliseum Boulevard Montgomery, Alabama 36130

Mr. Robert Joslin Regional Forester U.S. Forest Service 1720 Peachtree Road, NW., Suite 800 Atlanta, Georgia 30367

Regional Administrator
Attention: Endangered Species Coordinator
Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street
Atlanta, Georgia 30303-3104

*Dr. David Etnier Department of Zoology and Entomology University of Tennessee Knoxville, Tennessee 37916

Dr. George Folkert Department of Zoology-Entomology Auburn University Auburn, Alabama 36849

Mr. Floyd Frasure County Judge Executive McCreary County Courthouse P.O. Box 699 Whitley City, Kentucky 42653

Dr. William H. Redmond Regional Natural Heritage Project Tennessee Valley Authority Norris, Tennessee 37828

Mr. Robert McCance, Jr., Director Kentucky State Nature Preserves Commission 801 Schenkel Lane Frankfort. Kentucky 40601-1403

Alabama Natural Heritage Program Huntingdon College Massey Hall 1500 East Fairview Avenue Montgomery, Alabama 36106-2148

*Dr. Thomas Jandebeur Athens State College Department of Biology P.O. Box 215 Athens, Alabama 35611

*Dr. Robert Jenkins Department of Biology Roanoke College Salem, Virginia 24153

Mr. Robert Knarr
Commissioner and Enforcement
Department for Surface Mining Reclamation
Kentucky Natural Resources and
Environmental Protection Cabinet
5th Floor, Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. Brian Knowles Daniel Boone National Forest 1700 Bypass Road Winchester, Kentucky 40391

*Dr. Jim Layzer Tennessee Technological University Cooperative FisheryResearch Unit Box 5114 Cookeville, Tennessee 38505

*Dr. Richard Mayden University of Alabama P.O. Box 870344 Tuscaloosa, Alabama 35401

*Dr. Scott Mettee Geological Survey of Alabama P.O. Drawer 0 University Station Tuscaloosa, Alabama 35486

Alabama Department of Environmental Management Water Quality Programs State Capital Montgomery, Alabama 36130

Mr. Leigh Pegues, Director
Alabama Department of Environmental Management
1751 Congressman W.L. Dickinson Drive
Montgomery, Alabama 36130

*Mr. Malcolm Pierson Alabama Power Company, GSC #8 P.O. Box 2641 Birmingham, Alabama 35291

Ms. Laura Knoth
Director of Environmental Affairs
Kentucky Farm Bureau Federation
P.O. Box 20700
Louisville, Kentucky 40250-0700

Environmental Assessment Section Kentucky Natural Resources and Environmental Protection Cabinet Department for Natural Resources Division of Abandoned Lands 618 Teton Trail Frankfort, Kentucky 40601

*Dr. Robert Stiles Samford University 800 Lakeshore Drive Birmingham, Alabama 35229

*Mr. Carl Sullivan
Executive Director
American Fisheries Society
54 Grosvenor Lane
Bethesda, Maryland 20814

U.S. Geological Survey Water Resources Division 520 19th Avenue Tuscaloosa, Alabama 35401

Mr. William J. Kovacic Office of Surface Mining 2675 Regency Road Lexington, Kentucky 40503-2922

Mr. Hollice Upchurch County Judge Executive Wayne County Courthouse Monticello, Kentucky 42633

Mr. Peter W. Pfeiffer, Director Kentucky Department of Fish and Wildlife Resources Department of Fisheries #1 Game Farm Road Frankfort, Kentucky 40601

Dr. Melvin Warren
U.S. Forest Service
Southern Forest Experiment Station
Oxford, Mississippi 38655

Mr. David Yancy
Kentucky Department of Fish and
Wildlife Resources
Department of Fisheries
#1 Game Farm Road
Frankfort, Kentucky 40601

Dr. Guenter A. Schuster, Professor Department of Biological Sciences Eastern Kentucky University Richmond, Kentucky 40475-0950

Project Manager (7507C)
Environmental Protection Agency
Endangered Species Protection Program
Environmental Fate and Effects Division
Office of Pesticide Programs
401 M Street, SW.
Washington, DC 20460

Ms. Alice L. Gustin
Publisher/Editor
Land Use Chronicle
P.O. Box 468
Riverton, Wyoming 82501

The Nature Conservancy
Eastern Regional Office
201 Devonshire Street, 5th Floor
Boston, Massachusetts 02110

The Nature Conservancy 1815 N. Lynn Street Arlington, Virginia 22209

Mr. Rich Owings North Carolina Arboretum P.O. Box 6617 Asheville, North Carolina 28816

Dr. Gary B. Blank North Carolina State University Box 8002 Raleigh, North Carolina 27695-8002

Mr. Alan Smith P.O. Box 887 Mars Hill, North Carolina 28754 Mr. Mike Turner (PD-R)
U.S. Army Corps of Engineers
Louisville District
P.O. Box 59
Louisville, Kentucky 40201

U.S. Forest Service Wildlife, Fisheries, and Range 1720 Peachtree Road, NW. Atlanta, Georgia 30367

Traffic U.S.A. World Wildlife Fund 1250 24th Street, NW., Suite 500 Washington, DC 20037

The Nature Conservancy 642 West Main Street Lexington, Kentucky 40508-2018

U.S. Fish and Wildlife Service Cookeville Field Office 446 Neal Street Cookeville, Tennessee 38501

U.S. Fish and Wildlife Service Daphne Field Office 2001 Highway 98, Suite A P.O. Drawer 1190 Daphne, Alabama 36526

U.S. Fish and Wildlife Service Jackson Field Office 6578 Dogwood View Parkway, Suite A Jackson, Mississippi 39213

Mr. Robert Hatcher Tennessee Wildlife Resources Agency Ellington Agricultural Center P.O. Box 40747 Nashville, Tennessee 37204

Mr. Reginald Reeves, Director
Endangered Species Division
Tennessee Department of Environment
and Conservation
401 Church Street
8th Floor, L&C Tower
Nashville, Tennessee 37243-0447

The Nature Conservancy 50 Vantage Way, #250 Nashville, Tennessee 37228-1504

Environmental Protection Agency Hazard Evaluation Division - EEB (TS769C) 401 M Street, SW. Washington, DC 20460

Fish and Wildlife Reference Service 5430 Grosvenor Lane, Suite 110 Bethesda, Maryland 20814

Mr. Julius T. Johnson Director of Public Affairs Tennessee Farm Bureau Federation P.O. Box 313 Columbia, Tennessee 38401

Mr. Charles P. Nicholson Endangered Species Specialist Tennessee Valley Authority 400 West Summit Hill Drive Knoxville, Tennessee 37902-1499

Ms. Rachel Thomas Box 4637 Huachuca City, Arizona 85616

Mr. Paul Tyler P.O. Box 66 Humboldt, Arizona 86329

Mr. Howard Hutchinson P.O. Box 125 Glenwood, New Mexico 88039

Mr. Bill Evans The Waterways Journal 4051 Veterans Boulevard, Suite 401 Metairie, Louisiana 70002

Environmental Services, Inc.
Attention: Ms. Sarah Robinson
8711 Perimeter Park Boulevard, Suite 11
Jacksonville, Florida 32216